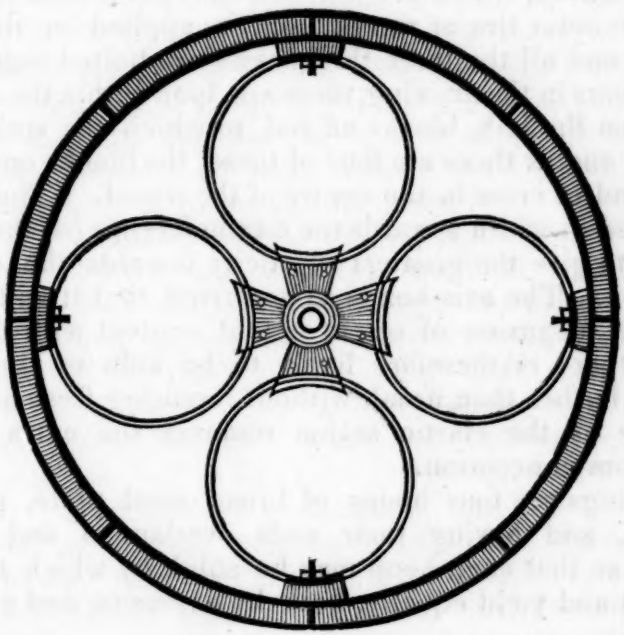
BOSTON MECHANIC,

AND

Journal of the Useful Arts and Sciences.

OCTOBER, 1835.

CIRCULAR SPRING WHEELS.



THIS account of a 'Circular Spring Wheel,' patented by a Mr. William Adams, in England, is taken from the London Mechanics' Magazine. The article in the original is very diffuse, but we have presented, in a condensed form, all that appears essential to the understanding of the invention.

AMONG the various plans which have been resorted to for diminishing the effect of concussions upon carriages, produced by the inequalities and obstacles in roads, that of

placing springs in the wheels themselves seems to have been quite the last thought of. Usually, the springs have been made the medium of connection between the axle of the wheels and the body of the carriage, thus serving to relieve the latter only from the violence of the concussions. But by the present method, not only is the carriage secured, but the wheel itself, which is the greatest sufferer, is benefited.

The following is the principle of construction :—instead of longitudinally rigid spokes, which, situated as they are, perpendicularly, are in the position the most liable of all to receive the full force of the concussion, and to suffer proportionate injury, the patentee has, in the contrivance before us, substituted elastic rings, placed around the axle, and within the circumference or felloes of the wheel; and bolted by their opposite sides, respectively, to the hub of the axle and to the inner side of the rim.

An inner iron rim is placed, we learn, within the wooden circle of felloes, which are fastened to it; and after these are fixed, the outer tire or rim of iron, is applied in the usual manner; and all the three thicknesses are bolted together.

As appears in the drawing, there are, both within the external rim and on the hub, blocks affixed, to which the springs are fastened; and as there are four of these, the blocks on the hub form a kind of cross in the centre of the wheel. 'The springs are tapered in width towards the circumference (of the wheel) in order to give the greatest elasticity towards the point of concussion. The axis-box is so contrived that it will carry a very large magazine of oil in actual contact with the axis; and the wheel is therefore likely to be able to travel considerably farther than usual, without requiring fresh oil; more especially as the elastic action removes the extra friction arising from concussion.

'The rings are four hoops of broad steel plate, properly tempered, and having their ends overlapped and riveted together, so that each hoop may be solid, by which means it will resist and yield equally, both by extension and compression.

'The nave or hub, is made of iron flange plates, fitted to the axis-box, and reinforced by wood blockings. The flange plates are made in the form of a Maltese cross, to the arms of which the hoop springs are firmly fixed, each with four clip bolts and nuts, without making holes in the spring.'

Considerable advantage is supposed to be derivable from the employment of this wheel on railroads, in the preservation of both rails and carriages; and it is also thought that

the tendency of the wheels to run off the rails, when not pursuing a straight line, will be in some degree prevented by the peculiar construction of the spring wheel.

'An elastic wheel possesses another advantage over a rigid one, in case of a defect in construction incident to all wheels, viz. eccentricity, or the absence of roundness. A rigid wheel of this form must necessarily move with much friction; but the elasticity of the spring wheel would tend to correct this defect, by yielding, where there was the necessity, during its revolution.'

NATIVE ARTISTS AND THE ARTS.

[Furnished for the Boston Mechanic.]

Perhaps the better way to cherish native ingenuity and enterprize would be, not to impose a tariff on foreign productions, but to be willing to encourage those of our own land, even at the risk of paying a higher price for them than for the foreign article; which will be the sure way to make them, by and by, cheaper, as it will so much the better enable the producers to work upon a more extended scale, and consequently, with greater facilities.

The more common trades, which require, comparatively, the exercise of little skill and little intellect, will get along well enough; but would we encourage the higher branches of the arts among us, we must assuredly take good care of the artists. It can hardly be expected that one should be able to acquire fortunes, in a business the acquisition of which, even to mediocrity, is a labor of many years, requiring much capital, as well as extensive study, research and experiment, for its successful prosecution, and the proceeds of which, after all is done, must be costly—and often not only so, but having necessarily a limited demand, as is the case with philosophical and astronomical instruments,—unless some peculiar encouragements should be afforded by efficient patrons of the liberal arts and sciences.

Nevertheless, these articles must be had, and made, by somebody. Somebody must take upon his shoulders the expense, and incur the difficulties which lie in the way of their successful construction. In this country, the prosecutors of these branches of art, as well as the cultivators of the sciences, have a great disadvantage compared with those of the old country. There is here no *royal* favor, no royal

munificence, to be lavished upon the deserving or the undeserving; there are no royal patrons of the arts and sciences, ready to bestow both their sanction and their guineas upon the makers of important improvements and discoveries. Unwilling as we plain republicans are, to allow a grain of superiority to kingly governments, we are obliged to confess that however they have oppressed their people, they have been efficient promoters of science and the arts.

But our native pride will, we think, prevent us from answering in the negative the question—'Are we not able to give as ample support to *these* pillars of civilization, as we are to our boasted freedom, and to the rights of man?' And if this question be answered—'Yes,' we believe it will be truly answered. Why is not our *government* able to bestow as efficient patronage on scientific research and discovery as the royal associations, which so liberally dispense rewards and favors in Old England?

But it is true that science and the liberal arts have not met, in this country, with that encouragement which is necessary to their prosperity. The best and almost the only *general* standard scientific journal among us, has languished, for want of aid. Our artists have preferred even to leave the land of liberty, for the sake of finding a clime where they might reap a profit from their labors.

But it will not be so always. If the disasters of another revolution should not suddenly overtake us, (which may God avert,) we cherish a hope of soon seeing the ways of knowledge and scientific research as profitable, and as generally honored, as the less intellectual pursuits which so absorb the minds of a great portion of us. Nor do we fear that in heaping rewards upon the pioneers of useful knowledge, in its high and difficult departments, we shall the more degrade those by whom these honors are unattainable. No! we are assured, on the contrary, that before these heralds of science can be, among us, suitably rewarded for their exertions, the people must be *raised*—not depressed; instructed—not fettered in ignorance; taught enough of science to respect it for its own sake, instead of bowing down blindly and wonderingly before its possessors.

We regard, then, the education of the people, and the culvation of the higher branches of science and art, as causes which must go hand in hand, and stand or fall together. The *people* are sovereign here; and what kings are not here to do, with their royal munificence—perhaps extravagance—the people must do by their liberality and patriotism. They

who give law to the land, must give strength to the wings of genius, and themselves urge forward the wheels of research and invention, if they would see the temples of science and art, rising beside those of liberty. A—z.

BLEACHING PAPER IN ENGLAND.

[From the London Mec. Magazine.]

Against the practice of bleaching paper I do protest. The consequences of using chlorine—which has the property of destroying ink and other colors—are, that many valuable epistles become illegible, and some have even dropped to pieces on the road. Some of our best modern books are already tottering on their shelves; and numerous deeds and valuable writings, requiring to be kept a great number of years, will, ere a very few, become useless. I have in my possession the remnant of a royal octavo volume, one of an edition of 30,000 copies, printed at the University press in 1818; and it is a singular fact, that there is not a perfect copy now existing. We find that when anything of a delicate color is wrapped up in white paper, the color is destroyed. A silk manufacturer once told me he could not preserve his colored silks; he used the whitest and cleanest paper he could procure to wrap them in, but the colors invariably faded. I told him for the future to wrap them in common colored, or brown paper—he did so, and the silks retained their delicate hues. Paper stainers have lost hundreds of pounds in value, in consequence of the destruction of their goods by chlorine. This gas has also the property of dissolving gold. I knew a button merchant, who sent a quantity of gilt buttons to London for sale: being an expensive article, he took care to have them securely packed in white paper, that they might be kept perfectly clean. The consequence was, that the gilt corroded, and the buttons were returned unsaleable. Everything now-a-days—such is the rage for bleaching—must be bleached. Our linen must be bleached, though by that means we render it yellow; our calico must be bleached; our ginger must be bleached, although at the expense of destroying the very principle which renders it valuable; and by-and-by, I suppose, we shall be bleaching our daily bread. Let us, however, view

the case as we ought. If we have an inferior article, paper, for instance, the fault is ours, not the paper maker's.

We fix our prices, and if I am determined to have a quire of paper for 4d., the manufacturer, knowing he cannot furnish it of sterling quality, is obliged to resort to the expedient of bleaching, for the purpose of giving a good exterior to a bad material. Perhaps the subject may be illustrated this way:—Suppose I want a pound of confectionary: I walk into the confectioner's, and say, 'If you let me have it for 4d. I 'll take it, and if not, why, I can obtain it elsewhere;' never, for a moment, recollecting that the very materials, or perhaps merely the sugar, costs double the sum. The consequence of this mode of proceeding is, that we have the privilege of swallowing with our confectionary a sufficient quantity of chalk. To such a pitch has the bleaching of paper been carried, that government find themselves obliged to employ a person to watch the manufacture of the paper they require, for the purpose of securing it of a good quality. I know of two cases in which letters containing money have fallen to pieces by the road. One was directed to the post-master of Sheffield; and it so happened that the check was found in the post bag: the person for whom the other letter was intended, was not so fortunate. Everything is now made up into paper, and in consequence of its being bleached, we do not easily detect the inferiority. I have by me specimens of paper made not only from wool and leather, but from the bark of the willow, from hay and straw, potato peelings, wood shavings, saw-dust, and, in short, anything can be made into paper, ***such as it is.***

ILLUMINATED STREET SIGNS.

[Furnished for the Boston Mechanic.]

Messrs. Editors:—I wonder whether it is because everybody that can reasonably be expected to be interested in city improvements, knows all the streets by heart, that no attempt has ever been made to render the names of the streets at the corners, visible in the night-time. Were lamps hung against those signs—and that would be, as far as I can see, as good a place, for all other purposes, as they generally occupy—the evil would at once be remedied. In England, where they go ahead of us in everything, except in the matter of the

freedom of the people, &c., of which we are wont to boast, they have contrived the plan of embossing or painting the names of the streets on the cross-bars placed for the lamp-lighters' convenience at the top of the lamp-posts. The sides of the said bars being slanted off somewhat from above, the light from the lamp, falls down and illuminates the name so that it may be read. It might be well, I think, for some of our wiseacres to meditate profoundly for a while on this subject, laying by, for a season, perpetual motion and cooking stoves, of which articles there is already an abundance in market.

MORE LIGHT.

CEMENTATION OF IRON BY MEANS OF CARBURETTED HYDROGEN.

[From the Journal of the Franklin Institute.]

Mr. Macintosh, one of the best informed mechanics in England, and to whom the chemical works in the neighborhood of Glasgow are indebted for many improvements, conceived the idea of making steel of cementation, by exposing iron to a current of carburetted hydrogen gas. The apparatus which, after various trials, he found most convenient, consisted of a tube of cast iron, coated inside with stiff clay, the same that is used in the construction of the furnaces on the Clyde. In order to prevent the usual contraction of clay, it is mixed with about a third of the same clay, baked, and afterwards reduced to a sufficiently fine powder. The tubes used by Mr. Macintosh, vary in length from five to six feet, the internal breadth from ten to eleven inches. The lining of clay is two inches thick; it should be well beaten, and have no fissures. To effect this, a cylinder of wood, rather less in diameter than the bore of the apparatus, is introduced, and the clay is then placed by small successive layers, as is practised in making pots for glass factories.

The tube has pipes at each end, one serving for the introduction of the carburetted hydrogen, while the gas escapes by the other; both these pipes are exactly closed, so that the carburetted hydrogen may remain in the tube as long as it is judged proper.

The tube is placed in a furnace, disposed in such a manner that it may be surrounded on all sides by charcoal. Each tube is filled with from a hundred to a hundred and fifty

pounds of iron. The bars are placed lengthways in the tube, taking care to keep them apart, and to separate every layer by small bars placed crossways, so that the hydrogen gas may be in contact with their whole surface. After the fire is lighted, and when the tube is sufficiently heated, a current of carburetted hydrogen gas, produced by the distillation of coal, is passed through. But in order that the gas and the iron may acquire the proper temperature for cementation, the hydrogen is removed only every half hour. At the end of this time, the hydrogen gas is, in a great measure, deprived of the carbon it contained, and on escaping from the tube, burns with a feeble light.

The time necessary for cementation depends upon the dimension of the iron bars to be cemented, and upon the temperature to which the apparatus is exposed. When the tube of cast iron is of a reddish brown, and when the bars are two inches broad by six lines thick, only eighteen or twenty hours are requisite to complete the operation. The iron may be overcharged with carbon, with great facility. I have seen thin bars, which were almost in the state of graphite. Proof bars, placed in the disks which close the tube, mark the state of cementation, and the moment when the operation should be stopped.

The steel, when taken from the tube, is covered with small blisters or bubbles, and entirely resembles steel cemented by the ordinary process. Mr. Macintosh is convinced that this process can, with regard to expense, sustain a competition with the ordinary method of cementation. He considers the steel obtained by the hydrogen gas as more homogeneous, and of a superior quality to that produced by the ordinary process.

AMERICAN PORCELAIN CLAY.

We find, in an old work, (published in 1810,) an account of the discovery of porcelain clay in this country, of which the following is the substance, embracing some curious items.

About eighteen (now over forty) years ago, two men in the town of Monkton, in Vermont, were digging for iron ore, and about four feet from the surface of the ground, came to a white substance, which, from its resemblance to white lead, they supposed would make putty. They accordingly made trial of it, and found it to answer their best wishes. They

afterwards penetrated the bed about twenty-five feet, and observed the material to grow more pure, the farther they went down. Considerable quantities of putty have since been made and carried abroad for sale; and by those who have used it, it is preferred to any other. A house in Vergennes was also painted with it, about sixteen years since, and still exhibits a hard coat, impervious to the weather. Owing to the narrow circumstances of the then owners, and the doubts and scruples of people about letting a certainty go for an uncertainty, as they called it, this material was rather talked of as valuable, than put to the test of experiment, though it was still used in towns in the vicinity of the bed; and it was not till a little more than a year ago, that any adequate ideas were entertained as to the real properties and value of the 'putty stuff,' as it was called.

This long-neglected material was afterwards ascertained to be porcelain clay, and a company was formed, with a view of manufacturing it into crockery and china ware. A very excellent kind of stone ware is already made, by mixing it with a certain proportion of common blue clay. This clay is found on the eastern side of a hill rising in an angle of about forty degrees, and is deposited in strata, having a variable number of degrees of northern depression, and the strata are intersected by veins of pure flint sand, valuable in the manufacture of flint glass.

In an analysis of 100 grains, they yielded 56 of pure silex; the remainder was pure clay, a little water, and a very small portion of oxyde of iron, though scarcely perceptible. When submitted to a strong heat, it forms into a solid porcelainous mass, without fusing, and retains its whiteness.

It has a great affinity for oil; and it is found that, mixed in equal parts, it even improves the whiteness of white lead, and adds greatly to its power of resisting the action of the atmosphere. It must, of course, be a very useful article in painting.

A ROTARY ENGINE.

Notwithstanding the general comparative uselessness of rotary engines, we learn from the New York Mechanics' Magazine that Mr. William Avery has there invented one which goes, to the satisfaction of all parties concerned; and is employed to drive a printing machine. On the principle,

probably, that simplicity is preferable to complication, in everything, he has dispensed with pistons, cylinders, and various other apparatus usually found in steam-engines; his engine consisting simply of pair of opposite hollow arms, on the end of a hollow axle, on which the steam operates precisely on the principle of the reaction wheel, by which, we presume, some of our readers may have been amused, if not puzzled to imagine how water spirted through a pipe could cause it to whirl round.*

The engine is of two horse power. The boiler, including the fire chamber, is 17 inches in diameter, and 78 inches (6 feet 6 in.) in height. The arms or eduction pipes, which the steam, in passing through, causes to revolve, giving motion to the working axle on which they are fixed, perform the rather astonishing number of *five thousand* revolutions per minute, being eighty-three and a fraction over per second.

It is remarked—'The principal advantages of this engine, as we conceive, consist in its compactness, the ease with which it is managed by any person who can tend the fire, the trifling cost of fuel, as well as the small outlay for the engine. The most important advantage, however, for many purposes, and especially for driving printing machines, will be found in its perfectly uniform motion.'

The following is a description of a six horse engine, of this construction:

'The engine, that is, the shaft and arms, weigh, as I learn, only 15 lbs.; the arms, from centre of shaft to their ends, are 18 inches, and in their revolutions describe a circle of 9 feet 5 inches in circumference; the two apertures at the end of the arms are equal to the eighth part of a superficial inch, and under a pressure of 80 lbs. to the square inch, will balance a weight of 10 lbs. From some experiments made, it is estimated to carry a load of 8 lbs. through a space of 37,666 feet per minute. The boiler has 66 feet of surface exposed to the fire, and consumes daily half a cord of soft dry wood.'

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* The reaction wheel consists of a pipe, on the end of which is fixed a hollow revolving pipe, cross wise, the ends of which are usually bent or turned a little to one side. When air or water is forced through this machine, it causes the cross tube to revolve rapidly.

AMERICAN PATENTS.

[Abridged from the Journal of the Franklin Institute.]

PATENT *for an improvement in the Machinery for Manufacturing Paper;* John Ames, Springfield, Hampden county, Massachusetts, February 20.

This patent is taken for the manner of applying a drying cylinder to machines for manufacturing paper. Those acquainted with these machines, know that the paper, after passing through the press rollers, is subjected to the action of large hollow cylinders, by passing over which it is effectually dried, these cylinders being heated by steam or hot air, which passes into them through a hollow gudgeon. The patentee substitutes the drying cylinder for the upper press roller; these cylinders are, in preference, made of cast iron, and from nine to twelve feet in diameter; the lower press roller is to be borne up against the cylinder by means of weighted levers, with such force as to cause the drying cylinder to revolve.

PATENT *for a Machine for Cleaning Clover and other seeds;* Joseph Ross, Boundbrook, Somerset county, New Jersey, February 6.

A horizontal cylinder, which may vary in dimensions, is set with teeth of two kinds; one set, from one quarter to one half an inch in length, forming circles around the cylinder, which are an inch, more or less, apart. Between these, rows of longer teeth, wires or sprigs (query—*springs?*) are driven, which should not stand out more than one sixteenth of an inch, their office being to rub the seed from the husk. A concave surrounds the cylinder for about three quarters of its circumference; and the part under the cylinder is punched with holes, or may be made of woven wire work, fine enough to allow the seed only, and not the chaff, to pass. In front of the cylinder are rubbers, made of sole-leather, pressing against the cylinder. The seed is first submitted to the action of these, and what escapes is carried on by the action of the longer teeth, over the perforated part of the concave.

PATENT *for a Self-adjusting Cheese Press;* Rufus Porter, Billerica, Middlesex county, Massachusetts, February 6.

This is a rather curious contrivance, in which the cheese is made to press itself. It may be wondered how this can be done; but we may not be able to explain it without a drawing, which we cannot give. The bed of the press and the follower are both fixed in sliding grooves, and

connected with various-sized pulleys by ropes. The mode of operation seems to be, that the cheese, in bearing down by its own weight the bed, on which it is set, which, as we have remarked, slides in a groove, pulls down the follower also upon it; but through the intervention of the pulleys, by which velocity is gained, it pulls it down faster than it sinks itself, and so must needs be pressed. The patentee says the force of pressure will be eighteen times the weight of the cheese. It is a query whether a small cheese could press itself hard enough in this machine; and also whether one of larger dimensions than the patentee has calculated for, would not be too forcibly squeezed.

PATENT *for a Machine for Shelling Corn;* Jonathan H. Taylor, and Aaron J. Cowley, Westfield, Chautauque county, New York, February 11.

This machine differs considerably from others for the same purpose. A cast iron wheel, fifteen inches in diameter, is made to revolve vertically, by means of a winch; the wheel has spurs or points, on each side, to aid in shelling the corn, and on its edge there are teeth, which give motion to a wheel or pinion, on a second shaft; this second shaft carries two cast iron wheels, one foot in diameter, embracing the main wheel, first described, between them; each of these wheels has a wide rim cast on it, which inclines towards the main wheel, reducing the interior diameter to ten inches; upon these rims there are cross teeth, upon which the ears of corn are fed, being made to run down two inclined troughs or hoppers, when, by the combined motion of the main and secondary wheels, the ears are made to revolve, and the grain is shelled off.

THE SOLAR SYSTEM IN MINIATURE.

THE following illustration of the relative sizes, distances, and times of revolution of the planets is taken from Sir J. W. F. Herschel's treatise on astronomy, published in Lardner's Cabinet Cyclopedia, with the single alteration of substituting the radii of the circles of revolution instead of their diameter; and a few corrections in the figures:

'Choose any well levelled field or bowling green. On the centre, place a globe two feet in diameter to represent the sun. Mercury will be represented by a grain of mustard seed on the circumference of a circle of 82 feet radius; Venus by a pea on a circle of 142 feet radius; the earth

also by a pea on a circle of 215 feet; Mars by rather a large pin's head on a circle of 327 feet; Juno, Ceres, Pallas and Vesta, by grains of sand, in orbits of from 500 to 600 feet radius; Jupiter by a moderate sized orange, in an orbit whose radius is about a quarter of a mile; Saturn by a small orange on a circle of two fifths or nearly half a mile radius, and Uranus, [sometimes called Herschel] by a full sized cherry or small plum, in an orbit whose radius is more than three quarters of a mile.

'To imitate the motions of the planets in the above orbits, Mercury must describe its own in 41″; Venus in 4′ 14″; the Earth in 7′; Mars in 13′ 11″; Jupiter in 2 h. 56′; Saturn in 3 h. 13′; and Uranus, (or Herschel,) 9 h. 16.′'

ON THE NEGLECT OF VENTILATION.

[Furnished for the Boston Mechanic.]

A season is now approaching, when there is an increased necessity of calling the attention to this topic, because the weather, in a climate so severe as ours, leads people to be too much afraid of the air; as well as on account of the multiplied apparatus for heating rooms which will soon be put in general operation.

Fresh air is one of the greatest blessings of life—at least, if anybody would think so. Yet no article of daily use is more liable to be deteriorated, and rendered unfit for service, than the air, whether any one is disposed to think so or not; and many, it is probable, hardly think at all about it.

Many mechanics labor in small confined shops, where not only their breathing—which, for a period of twelve working hours, is quite sufficient to poison the air—but the effluvia of their materials, which is sometimes highly injurious, combine to render the atmosphere in which they labor extremely unhealthy. They may not know this; or at least, do not think of it; but they are none the less injured by their ignorance.

In some of the countries of southern Europe, mechanics labor during the pleasant season, in the open air. The shoemakers and basket-weavers, by dozens, place their benches in front of their shops, in the open street, in many of the Italian cities; and we have no doubt that the practice might be

found beneficial to health among us; and perhaps, even a day's work might be performed with much less actual fatigue; —for who does not know the relaxing effect of a close warm atmosphere on the system? True, our climate is not so mild as that of Spain and Italy; but here, as in other quarters of the globe, it is allowed that those whose vocation leads them to labor in the open air, such as gardeners and husbandmen, are in general, a very healthy class; and why, then, should not the same circumstances operate beneficially on mechanics?

But perhaps there is no need of recommending to our shoemakers and other tradesmen, to work out of doors. But small, tight rooms, with close stoves, and heated to an undue temperature, in which they often pursue their business, are most certainly highly improper. Fireplaces, in all situations, provided they perform their duty, that of warming the atmosphere of the room, in which they are built, are more healthy than close, or even perhaps open stoves.

For some reason or other, whether explained or not, air which comes in contact with highly heated metallic surfaces, is rendered peculiarly unpleasant and unwholesome. Still, however, there are reasons why, in many cases, stoves are to be preferred. Their evil effects are partially remedied, by saturating the atmosphere with vapor, from water heated on the stove; and perhaps more successfully, but whether entirely or not we do not know, by interposing in them, earthy substances, as brick, between the fire and the metal.

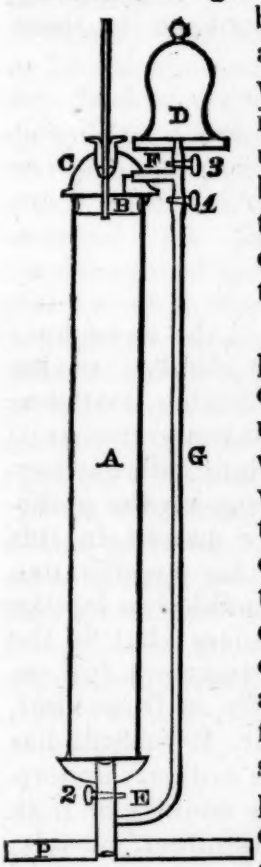
At all events, let the air we breathe be pure, as well as warm; and let means be provided for due supplies from without, as fast as it deteriorates, even though it should cause a little extra expense of fuel in warming it.

The air of the open country, at all seasons of the year, is more wholesome than that of the city. The difference is, without doubt, much less in the cold season than in the warm, when effluvia cease to rise so abundantly; but there is some, even then. But since many, especially mechanics, among the poorer classes, must live in the city, let them take so much the more pains to inhale the freshest air they can have access to; and let large rather than small rooms be chosen, in which the greatest portions of our time, or of our hours of labor, are to be spent.

IMPROVED AIR-PUMP RECEIVER.

This air-pump was invented by Mr. John Bell, of New York; and was the subject of a paper recently read by him before the New York Mechanics' Institute, the Corresponding Secretary of which, Mr. L. D. Gale, forwarded this account to the American Journal of Science and Arts.

The drawing represents a metallic cylinder A, which is to be connected with P, the plate of a common air-pump, by means of a screw, and the vacuum is to be made in the receiver D. B is a piston well packed, and fitted to move up and down in the cylinder; C, a stuffing box through which the piston rod passes air tight; E and F, metallic tubes of small bore communicating with the air-pump plate P, the cylinder A, and the receiver D.



Having screwed the apparatus upon the plate P, open the stop cocks, 1, 2, 3, and exhaust the air within the receivers, in the usual way, until the elasticity of the air within is no longer capable of raising the valves. Then closing the stop cock 1, force the piston B nearly to the bottom of the cylinder, by which the air before occupying the whole of the cylinder is so much condensed that its elasticity will raise the valves of the air-pump, and is by it removed. The air which, before depressing the piston B, filled only the receiver D, is now expanded so as to fill also the cylinder A. While the piston B remains at the bottom of the cylinder, close the stop cocks 3 and 2, and then open 1, and elevate the piston by the hand to near the top of the cylinder. The air which, before elevating the piston, occupied the whole space of the cylinder, is now compressed into that occupied by the bore of the tube E, G, F, and a small portion of the upper part of the cylinder, and has now acquired sufficient elasticity to raise the valves; and by working the pump, as before, is removed. Thus by elevating the piston B, and exhausting, and then depressing it and exhausting, provided the apparatus be well made, it is believed that the most perfect vacuum can be formed, equal for all practical purposes to the torricellian. The size of the cylinder A, may be increased to any dimen-

sions, and the rapidity of the exhaustion will be in the same proportion.

The above apparatus, it must be remembered, is intended only for such pumps as have their valves raised by the elasticity of the air within the receiver, and does not consequently apply to the pumps with metallic valves. It is not supposed or intended that the above receiver should be used in performing the common air-pump experiments, that require only a partial vacuum, but that it should be confined to those where a more perfect one is necessary.

SMOKE WITHOUT SOOT.

[From the London Mec. Magazine.]

Several indistinct notices have appeared in the newspaper press, both domestic and foreign, during the last twelve months, of a new mode of warming and ventilating, stated to have been discovered by Mr. Bernhardt, a Saxon architect of considerable eminence, and exemplified by him with extraordinary success in a number of public buildings on the continent. As Mr. Bernhardt has taken out a patent in this country for his invention, and the time for his specification has now nearly expired, we shall soon be enabled to lay the whole particulars of his plan before our readers; but, in the mean while, the following extracts from a statement authenticated by the signature of Professor Schaeffer, of Dusseldorf, may be accepted as good evidence that Mr. Bernhardt has actually arrived at some results of more than ordinary importance—one of which, at least, even in this country of high mechanical invention, is still a great desideratum, namely, *smoke without soot.*

The Royal General Post Office, many years ago, built a factory adjoining the post house, for the repair of the mail-coaches; and since the building of the diligences and the increase of business, it has become a very large coach manufactory, in which above seventy workmen are at present daily employed. In a building at the back, arranged for the purpose, a forge for ten fires was put up and erected in the usual form. Smoke and soot penetrated into the dwellings of the neighbors, and rendered them uninhabitable and worth no rent. Complaints and an expensive law-suit arose, which naturally terminated to the disadvantage of the post office

department. Experiments were then made to clarify the smoke and separate the soot. The Prussian consul in England—the land of invention—was desired to make inquiries whether any means were known to remedy the evil; but nothing could be done; and the most learned professional men doubted the possibility of an invention to answer the purpose, because it was believed that any attempt to separate the smoke from the soot could only be made at the expense of the draught.

At that time, the architect, Mr. Bernhardt, of Saxony, was in Berlin, and had been employed in the royal palaces. Having devoted the whole of his life to the study of the deficiencies at present existing in the construction of fires, he was enabled to correct the similar faults in the general post office buildings, and his plans were crowned with the best success. Mr. Bernhardt discovered the means of forcing the draught of the smoke, and separating the soot from it. His plans were carried into execution. In a short time, without any interruption to the business of the coach factory, the work was completed. The smoke ascends in a purified state through two cylinders of zinc to the roof, and the soot remains in the interior of the three story high building, concentrated in separate channels and chambers.

It is remarkable to observe the soot depositing itself in coarse particles, and afterwards becoming gradually finer as it ascends; and to see the smoke rising through narrow wire nets. In the channels of the five chimneys, a mass of $26\frac{2}{3}$ cubic feet of soot was found, after three months' purifying, and which had formerly been mostly conducted over the roof.

ON THE DIVISION OF LABOR.

[Original.]

It is equally true, both of the bodily and mental faculties and organs, that want of exercise weakens them, and renders them less able to exercise their appropriate functions. Those on the contrary, which are much exercised, become, under favorable circumstances, endowed with a great degree of strength. That man is the most perfect, as regards capacities for action, who has duly exercised every muscle, and every faculty of his mind.

Hence an occupation which exercises but few of the muscles, and especially, one which leaves little or no employment for the mind, when pursued without cessation or relaxation of any kind, must have an extremely unfavorable effect. A writer in the London Mechanics' Magazine, in an article on the 'Evil Effects of the Division of Labor,' makes some remarks which we wish to copy. The subject is a highly important one to those interested in manufactures, and the manufacturing classes.

The writer alluded to thus describes some of the evils of the system of division of labor, as it exists in England, affording a good illustration of our remarks above:

'The effects of this system upon society is truly deplorable. A poor boy, with very little education, is bound an apprentice for five or seven years, to do one particular act; he commences cheerfully, and in a few weeks can manage it completely; the only difference between him and a journeyman being, that he takes twice the time. He is now doomed through life to be a *mere machine;* all the delight he felt in learning his trade is over; he has no more mental work to perform, and he goes on from day to day with his monotonous task without excitement of any kind, save the temporary one of the gin-shop; there, amid the rudest ribaldry and mirth, he is exhilarated and *comparatively* happy. Next day he returns to his labor in the most melancholy and discontented mood. In short, as his profession does not exercise his intellect at all, he cannot fail to indulge in what *he* thinks his only pleasure. Let us suppose this to be continued until he reaches man's years, when the effect will be seen in an intellect blunted, and quite useless, from inaction. For we know well, that the thinking, like the physical part of the man is either perfectly or imperfectly developed—by proper or improper exercise. This man's brain is unexercised, nay, it is diseased; and he is in such a morbid state, that all his efforts to reform or improve his mind are ineffectual. He is both unable and unwilling to work; for the man who has spent twenty years of his life sharpening pin-points, or guiding a self-acting turning machine, has not physical strength to handle a spade or road hammer, even if he had not been previously wasted by dissipation.'

Of these evils, of which we have not copied more than half the description, it is maintained that long hours are not the sole cause; but that the division of labor is at the root of the evil. This, we have no doubt, is the case. The more you bring man down to the state of a mere machine—the less

chance you give him for mental occupation, about his business —the less a man you make him. Those who have little mind, lose what they have—at least the use of it—under such circumstances, and those who have much will not endure it, if they can help it. For instance, there are some minds, lively and ingenious, whom you can no more confine down to a mechanical trade, than you can make a shy bird forego the use of its wings. They will do a little of everything; and if they do not succeed well in anything, it is only for want of systematic application.

But our writer remarks farther, as follows; and if he is right, affords another equally strong argument against this excessively minute division of labor:

'There is another demoralizing effect yet to be noticed, which I shall endeavor to do as briefly as possible. An improvement in machinery often turns hundreds adrift upon society, who having spent the best part of their lives in some such trifling work as heading pins, are too old to learn another business, and for reasons already mentioned, they cannot do out-door work; their minds being untutored, they do not make a very vigorous effort to do their best at a new job, well knowing that they will not be allowed to starve in England. In many—very many cases, such men direct their blind rage to the breaking of machinery—not only the machine which superseded them, but machinery of all kinds; in short, a large proportion of the seditious, the incendiaries, machine-breakers, &c., which disturb the peace of society, are division-of-labor people, thrown out of work, and who have neither physical nor mental strength left to turn themselves to another decent employment.'

Hence, though the writer admits that this system affords the proceeds of manufactures at a much cheaper rate than could otherwise be done, he believes that the evils arising from it are such as by far to counterbalance all its benefits, and recommends to 'set on foot a proper plan of national education, to inquire into, and amend some of the absurd apprentice-laws, and put the rising generation in the way of acquiring more than one branch of a business, in order that their minds may be so far exercised as to make them good members of society, instead of converting them into mere machines for the acquisition of wealth.'

EXPLANATIONS OF TERMS.

[Furnished for the Boston Mechanic.]

THERE are those who would read works on natural philosophy, were they not deterred by meeting with words which they cannot understand; of some of which they might search in vain for a satisfactory explanation in our common dictionaries. One is, however, by no means justifiable in declaiming against the use of technical terms; which cannot always be avoided, in the plainest treatises upon many scientific subjects. Those who wish us to bring everything down to their comprehension, lay themselves open to the suspicion of being, in fact, too indolent to climb to the height which the subject ought to occupy; or at least, we must suppose them forgetful of the fact than in treating of things not commonly spoken of, we must sometimes employ words not commonly made use of.

The following explanations of terms in frequent use in scientific and practical treatises, will, it is believed, be found both useful and clear. The list may perhaps be hereafter extended.

SPECIFIC GRAVITY.—The difference in weight of equal bulks of different substances. See a particular illustration in No. 3, (May,) 1835.

SQUARE.—In arithmetic, the product of a number multiplied by itself, as 25, which is 5 times 5; 144, 12 times 12. The numbers 5 and 12 are also called the square roots of 25 and 144 respectively, and so on.

SQUARE OF THE DISTANCE.—Certain things, in philosophy, as the force of gravitation or attraction, and the intensity of light, are said to decrease in the ratio of the *square of the distance.* The meaning is this:—Suppose a body to be placed, say 2 feet from a light, or the centre of an attracting body, as a magnet, and another body 4 feet from the same. These bodies will be attracted, or illuminated, not in proportion to their distance, that is as 2 to 4, or in a double ratio, but as the *squares* of the distances; viz, as 4 (the square of 2,) to 16, (the square of 4,) that is to say, in a quadruple ratio; and in the same manner, if the second body was removed 10 feet off, it would be illuminated by the light, or attracted by the magnet, only in the proportion to the former of 4 to 100, (10 × 10.)

GRAVITATION.—Attraction; applied exclusively to the attraction of the earth for bodies falling towards it, and that of the heavenly bodies for each other.

CENTRIFUGAL FORCE.—A force tending to throw anything revolving, from its centre of motion, as water poured on a grindstone is thrown off, when the stone is turned rapidly.

CENTRIPETAL FORCE.—That which tends to draw a revolving body *towards*, or *hold* it near the centre of motion, as a string retaining a ball whirled in the air by the hand.

OXYDE.—Rust. A mixture of oxygen with metallic substances.

INTERESTING EXPERIMENT.

A BAR of iron heated to whiteness, being held against a strong current of air from the blowing apparatus of a forge, instead of cooling, as might have been expected, burned brilliantly, throwing off scintillations in every direction. The editor of the Scientific Tracts, who relates the account, does not undertake to account for it; but it is evident that the additional oxygen thus forced upon the already ignited metal, promoted the continuance of the combustion, chemically, in a much greater degree than its cooling power retarded it.

NOTES FOR OCTOBER.

THE PERPETUAL MOTION.—A few more words we wish to add in relation to this machine, to which some are disposed to deny the title of perpetual motion. It is a rather ingeniously contrived machine for taking advantage of the expansion and contraction of the air, by heat and cold, (and its barometrical variation will answer, perhaps better, the same purpose,) to the winding up of a weight to which any clock-work is attached. A geared rack is so contrived, by ratchet wheel pinions, moving in opposite directions, that whether rising or falling, it contributes towards the raising of the weight, through the intervention of appropriate wheel-work. As these atmospheric variations are constant, so will the winding up process be renewed as often as necessary. When the weight is wound high enough, there is a stop catch which intercepts the action till the weight, in its descent, releases it, and puts the gears again into play.

A Mountain Statue.—Dionocrates, an architect, whose patron was Alexander of Macedon, conceived the project of carving Mount Athos into a statue of that monarch. The head of this gigantic statue was to have been in the clouds, one hand was to have held a bowl, in which the waters of the mountain might be collected, (for it seems he was expected to sweat copiously,) and the other hand to have supported the edifices of a city capable of containing ten thousand inhabitants. It is said that Alexander, flattered by the suggestion of a project so gratifying to his pride and ambition, was deterred from taking measures to put it in execution, only by the consideration that though he could hold ten thousand people in his hand, it would not be convenient with nothing but a bowl of water in the other to feed them. Dionocrates, however, did not lose the reward which every man, who has any pretensions to greatness, must acknowledge he deserved for so magnificent a conception, and so appropriate a compliment to so great, so liberal, and so renowned a chieftain. At the building of Alexandria, employment was found for him, which if not so great in design, was probably as useful in the result, and far more practicable in execution.

Coal.—We are informed that in Mansfield, (in this state,) a bed of coal has been discovered, about ten feet below the surface of the ground. It is rather soft, and burns freely, but our informant was ignorant as to what kind of coal it was denominated. It had been tried and approved of, he states, by the blacksmiths.

Cements.—A composition of two parts ashes, three of clay, and one of sand, used by the Moors, being again mixed with oil, resists the inclemencies of the weather better than marble.

In building the Eddystone Light House, Mr. Smeaton made use of a cement composed of a mixture of lime of blue lias and puzzolana, in equal parts.

Patent Paint.—A person in Saco, has obtained a patent for a paint made from common soap-stone. It is said to be superior to white lead, and not half so expensive. This, if true, is quite a valuable recommendation.

Prussian Blue.—Old boots and shoes are now purchased by cartloads in New York, and taken to Harlaem, where they are manufactured into Prussian blue—a manufacture but lately established in this country.

Doors Opening Inwards.—A friend of ours wishes us to hint that an alteration some time ago proposed in the doors of the Masonic Temple, by which they should open outwards instead of inwards, has not been made. Notwithstanding it is the case, as we believe, with a great number of our churches, that the outer doors open inwards, this practice is liable to induce serious evils, in case of a sudden rush out of such buildings, on any alarm, in which case, if the doors were or should become shut, the crowd pressing against them would effectually prevent their being opened. It must be allowed, however, that in time of meetings, they generally remain open, and thus diminish the danger.

Building under Ground.—The injurious practice of building the vestries of churches below the surface of the ground, by which they are rendered damp and unwholesome, is, we see, complained of, and very justly, too, by the philanthropic press. Though we do not see how, as a writer is said to assume, it can be *cheaper* to build entirely above ground, we are equally at a loss to conceive why it should be more expensive; at least, so much more, as to warrant the sinking of one story of a building, that is to be used any length of time for human beings to breathe in, below ground, and thus securing for them the probability, if not the certainty, of dying with a consumption. The practice of building cellar kitchens, too, we think, ought not to be followed, though the effect of the damp may be prevented by the constant fires. But at best, they are unpleasant contrivances; and who would want to be obliged to live in a cellar?

Beet Sugar.—It appears that the manufacture of sugar from beets in the Russian empire, is greatly on the increase, and the beet-root of the central provinces is considered to be superior to that of France. A manufacturer named Davidhoff has ascertained that the whole of the juice may be extracted by cold water, with sulphuric acid, and that presses are not necessary.

Patent Bronze Sheathing.—This, an English invention, is recommended as considerably more durable than copper; and experiments are making, to test its good qualities. It is 2d. dearer per lb. than copper, but it is believed that its greater durability will more than make up for this. One advantage stated is, that whereas the copper is liable to be corroded into holes, the bronze wears uniformly over the whole surface.

Pyroligneous Acid.—A patent has been taken out for the application of this acid to the preservation of wood; and an experiment is about to be made on the blocks to be used for paving Broadway, in New York.

HALF STEEL.—The editor of the Scientific Tracts has picked up, somewhere or other, the following method of converting a bar of iron, on one side only, into steel:—First place a layer of coal, then of bars of iron, then of clay, or a clayey mixture, or any other substance not containing carbon, which the heat will not vitrify. Upon this lay more iron bars, then more coal and more clay, &c., throughout the batch. Being thus laid, and heated to a sufficient degree, that part of the bars covered by the clay will remain iron. Of course, therefore, the duration of the application of heat, and the quantity of carbon, must be proportionate to the quantity of steel required on each bar. If one edge only of the bar is to be steeled, care must be taken to place and keep the bars edgewise in the furnace.

INDELIBLE INK.—The following receipt, we should think, would be found both cheap and easy. We do not see, however, the necessity of the last direction. Why may not the writing be freely executed upon the linen?

'Take one part, by weight, of iron filings, and three parts of vinegar, or acetic acid, of spec. grav. 1,056. Mix the filings with half the vinegar, and agitate it continually. As it thickens, add the rest of the vinegar, and also one part of water. Then apply heat to assist the action, and when all the iron is dissolved, add three parts of sulphate of iron, and one part of gum arabic, previously dissolved in four parts of water. These are to be mixed well at a gentle heat, and will yield twelve parts of the preparation. The linen is to be spread on a table, and the preparation applied by means of a hair brush, and stencil plates of copper.'

MODE OF JOINING PIECES OF AMBER.—Wet the surfaces that are to be joined, with a solution of caustic potash, heat them, and press them together. They will unite so perfectly that no trace of any joint can be perceived. Thus, with small pieces of amber, compact masses may be formed, which is an advantage in the arts.—JOUR. FR. INST.

A NEW METALLIC CEMENT.—A patent has been taken out, says the London Mechanics' Magazine, for a new cement, consisting of powdered scoriæ from the copper works, mixed with stone and lime. It sets rapidly, and takes a fine metallic polish. It may be laid on in coats as thin as the fourth of an inch; but it has not been a sufficiently long time in use to determine to what extent it will be liable to crack.